Fuzzy Math: Do Current Relative Values Tell An Accurate Story?

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Fuzzy Math:
Do current relative values tell an accurate story?

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to

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The completed fitness report is the most important information component in manpower management. It is the primary means of evaluating a Marine's performance and is the Commandant's primary tool for the selection of personnel for promotion, augmentation, resident schooling, command, and duty assignments. Therefore, the completion of this report is one of an officer's most critical responsibilities. Inherent in this duty is the commitment of each Reporting Senior and Reviewing Officer to ensure the integrity of the system by giving close attention to accurate marking and timely reporting. Every officer serves a role in the scrupulous maintenance of this evaluation system, ultimately important to both the individual and the Marine Corps. Inflationary markings only serve to dilute the actual value of each report. Reviewing Officers will not concur with inflated reports.

-Commandant's Guidance, USMC Fitness Report (1610), NAVMC 10835A

Introduction

With the adoption of a new Performance Evaluation System in the late 1990's (more commonly referred to as a "fitrep"), the Marine Corps fielded a document with the ability to put each individual fitrep's average[1] into perspective using a corresponding numerical relative value.[2] As a result,

> "The relative value of a report allows individuals making personnel management decisions (promotion, augmentation, resident schooling, command, and duty assignments) to weigh the merit of that report in relation to the RS's rating history or 'profile' for all other Marines of the same grade reported on by the RS."[3]

As spelled out in MarAdmin 466/01, a report senior's (RS's) cumulative average[4] number was added to the Master Brief Sheet[5] (MBS) to amplify the RS's profile. However while originally designed to add numerical objectivity to the subjective task of writing fitreps, relative values can be skewed and can paint a misleading picture of the Marine reported on (MRO). Failure to

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[1] Marine Corps Order (MCO) P1610.7E, *Performance Evaluation System (PES)*, The Fitness report average for an individual report (is) the average of observed attributes (and) reflects the mean of the numeric values of the observed attributes on that report, G-1.

[2] MCO 1610.7E, *PES*, The relative value of a report reflects how the fitness report average of an individual report compares to:
(a) The RS's average of all fitness reports written by the RS on Marines of the same grade.
(b) The highest fitness report average of any report written by the RS on a Marine of the same grade as the MRO, G-2.

[3] MCO 1610.7E, *PES*, 8-10

[4] MCO 1610.7E, *PES*, Reporting Senior's (cumulative) average reflects the mean of the numerical value for all fitness reports (excluding academic type, end of service, extended, and not observed reports) written by the RS on Marines of similar grade, G-2.

[5] MCO 1610.7E, *PES*, The MBS is a ready reference document used in the personnel management process. The MBS provides key personal data and a summary of a Marine's performance evaluation record, 8-5.

depict the MRO's true performance allows the "law of unintended consequences" to potentially have a negative impact on Marines' careers. Because relative values are a heavily relied upon tool for selection boards[6], the Marine Corps must take immediate steps to correct the manner in which the RS averages and associated relative values are computed.

Current Problem

Although the concept of relative value would assume to provide added merit to personnel management decisions and facilitate appropriate decisions, the execution of the current model does not produce uniformly correct information. The Marine Corps has adopted a relative value scale of 80-100, with 90 as its average value[7] (RS cumulative average). In order to obtain the distribution required for a symmetrical bell curve (relative value curve) across this 80-100 scale, reporting seniors must write individual reports that have fitrep averages with a symmetrical spectrum of averages and a sufficient number of reports to develop a sample size that is large enough to produce meaningful information. In other words, as MCO 1610.7E states

[6] SgtMaj C.D. Castle, Sergeant Major, Personnel Management Support Branch (MMSB), interview by Capt E.P. Hovey, 6 January 2005.

[7] A relative value of 100 indicates the report has the highest fitness report average on any report written by the RS on a Marine of that grade. A relative value of 80 indicates the report has the lowest fitness report average on any report written by the RS on a Marine of that grade. A relative value of 90 indicates the report average for the report is equal to the RS average. (The average of the fitness report average for all reports written by the RS on a Marine of that grade.) MCO 1610.7E, *PES*, G-3.

> Reporting Seniors who consistently mark all their Marines the same, do their Marines a disservice because the reports will, for the most part, lack relative value in relation to all other reports written by the RS for Marines of the same grade.[8]

Further, it is common knowledge in statistics that outliers can have a significant impact on the averages of small sample sizes (number of observed reports on Marines of the same grade). As demonstrated in his paper[9], GySgt Payne demonstrates how the introduction of one new fitrep average can have a significant impact on the RS's cumulative average. The paper further demonstrates the effects that these dramatic shifts have on the associated relative values of the previously reported upon Marines. The following is a numerical example of the impact that an outlier can have on the averages.

Name	Fitrep Avg	RS Cumul. Avg W/out outlier	Relative Value W/out outlier	RS Cumul. Avg With outlier	Relative Value With outlier
SSgt Jones	3.6	3.875	80	4.1	80
SSgt Smith	3.8	3.875	88	4.1	83
SSgt Johnson	4.0	3.875	96	4.1	86
SSgt Allen	4.1	3.875	100	4.1	90
SSgt Jackson (Outlier)	5.0			4.1	100

Table 1

With the addition of SSgt Jackson's fitrep average to the equation (must also assume that the RS wrote SSgt Jackson's

[8] MCO 1610.7E, *PES*, 8-10.
[9] Payne, GySgt A.S. *Misleading Raw Scores on the Master Brief Sheet*. 2004

fitrep to have a higher average with intended impact), SSgt Allen's relative value changed from being the highest rated SSgt to one with an average rank (relative value of 90). Additionally, SSgt Johnson moved from solidly "above average" to the middle of "below average". Because the RS had a relatively narrow deviation in fitrep averages through the first four reports, the introduction of an outlier not only had an impact on the relative values, but also had the potential to change board members' perception of that MRO. Without the outlier, SSgt Johnson's and Allen's chances for selection may have been "solid" and a "sure thing," but with the addition of the outlier may now be "on-the-bubble" and "probably." In this example, SSgts Johnson and Allen may have been inadvertently hurt by an outlier; however, the converse is also true—a below average performer may be inadvertently helped by an extremely low outlier (in the case of an adverse fitrep). Similarly, if fitrep averages lack dispersion, it is difficult for board members to decipher which Marine(s) "stands out" from the other Marines that the RS has written fitreps.[10] Further compounding the problem, small sample size significantly impact relative values and their associated perceptions. Consequentially, current relative values may not serve their intended purpose.

[10] SgtMaj Castle interview

Recommended Solution

The current statistical method of obtaining the RS cumulative average (relative value of 90) should be changed in order to be a more accurate reflection of MRO performance.

> The mean[11] (RS cumulative average) is ordinarily the preferred measure of central tendency. The mean is the arithmetic average of a distribution (fitrep averages). The mean is the 'best' measure of central tendency for continuous data. (However,) in certain situations, the median[12] is the preferred measure. These situations are as follows:
>
> - When you know that a distribution is skewed
> - When you believe that a distribution might be skewed
> - When you have a small number of subjects
>
> The purpose for reporting the median in these situations is to combat the effect of outliers.[13]

Wide variations in command manpower structure lend itself to using the median in order to determine the RS's cumulative average. Both the RS's military occupational specialty and types of billets that the RS holds during his/her career will have a significant impact on the number of fitreps that he/she will write. For example, if a lieutenant stationed in a sergeant and staff non-commissioned officer-heavy community (like an amphibious assault vehicle battalion) subsequently goes to the drill field as a series commander, he will have written a significant number of fitreps. In contrast, a lieutenant in the intelligence field who subsequently goes to The Basic School as

[11] The sum of the values divided by the number of values—often called the "average".
[12] The value which divides the values into two equal halves, with half of the values being lower than the median and half higher than the median.
[13] Virginia Tech's web page

an instructor is likely to have written only a handful of fitreps over the same time period.

Although the median value has the ability to shift over time, the fitrep average associated with the median value will consistently have a relative value of 90. The median ensures that no more than 50% of the RS's fitreps will ever have "above" or "below" the relative value of 90 (not subject to skewed distribution). As demonstrated in Table 1 (with the addition of the outlier to the equation), the current use of the mean to determine the cumulative average would put four of the five individual fitrep averages in the "below average" category.

Counterargument

In contrast to transitioning to the median to determine the cumulative RS average, some would argue to maintain the status quo. As previously stated, the mean is ordinarily the preferred method of calculating central tendency. Additionally, calculating the mean is fairly straight forward, both conceptually and in execution. Further, the RS will eventually write enough reports to mitigate the effects of outliers. Finally, using the mean to determine the relative value average has appeared to work well enough thus far, so why fix something that does not appear to be broken?

Conclusion

As the saying goes, things are not always as they appear. Certainly the current use of the mean is not a problem of epidemic proportions on the macro level. However, the issue of transitioning to the median to determine the cumulative RS average must be considered. Failure to do so will erode the confidence that Marines and selection boards have in the validity of the raw data listed on the MBS. Leaders in the Marine Corps get paid to exercise judgment. It is far better leadership that sees an issue and prevents future problems than is forced to react to its ramifications.

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